2021-22 Mock
MATH CP
PAPER 2

CARMEL SECONDARY SCHOOL
HONG KONG DIPLOMA OF SECONDARY EDUCATION
MOCK EXAMINATION

MATHEMATICS Compulsory Part
PAPER 2

11 : 00 am – 12 : 15 pm (1¼ hours)

S6 ( )

Name: ____________________ ( )

Please circle your Math Group			
C1	C2	C3	C4
Mr CH Wong	Mr Leung	Mr KK Wong	Mr CH Wong

Date: 28 Jan 2022

No. of pages: 15

Total marks: 45

INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet.

2. When told to open this book, you should check that all the questions are there. Look for the words '**END OF PAPER**' after the last question.

3. All questions carry equal marks.

4. **ANSWER ALL QUESTIONS**. You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.

5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.

6. No marks will be deducted for wrong answers.

There are 30 questions in Section A and 15 questions in Section B.
The diagrams in this paper are not necessarily drawn to scale.
Choose the best answer for each question.

Section A

1. $\dfrac{3^{4n}(27^n)}{9^{3n}} =$

   A. 3^{4n} .

   B. 3^n .

   C. 3^{-2n} .

   D. 3^{-3n} .

2. If $3p(p-2q) = 2p - q$, then $q =$

   A. $\dfrac{3p^2 - 2p}{6p - 1}$.

   B. $\dfrac{3p^2 - 2p}{6p + 1}$.

   C. $\dfrac{3p^2 + 2p}{6p - 1}$.

   D. $\dfrac{3p^2 + 2p}{6p + 1}$.

3. $h^2 - 4hk - 12k^2 - 3h - 6k =$

   A. $(h-2k)(h+6k+3)$.

   B. $(h-2k)(h-6k+3)$.

   C. $(h+2k)(h-6k-3)$.

   D. $(h+2k)(h+6k-3)$.

4. $\dfrac{\pi^2}{222} =$

A. 0.044 (correct to 2 decimal places).

B. 0.0444 (correct to 3 significant figures).

C. 0.0445 (correct to 4 decimal places).

D. 0.04446 (correct to 5 significant figures).

5. Let $f(x) = (hx+10)(x-6)+k$, where h and k are constants. If $f(-2) = f(3) = 5$, find k .

A. -23

B. -3

C. 43

D. 53

6. Let a and b be constants. If $2x^2 + (a-3)x + a + b \equiv (x+4)(2x-5)$, then $b =$

A. –26 .

B. –6 .

C. 6 .

D. 26 .

7. Let $f(x) = 5x^2 - 1$. If α is a constant, then $f(\alpha) - f(\alpha - 1) =$

A. 5 .

B. $2\alpha - 3$.

C. $3 - 10\alpha$.

D. $10\alpha - 5$.

8. Let $p(x)=2x^2-x+c$, where c is a constant. If $p(x)$ is divisible by $x+2$, find the remainder when $p(x)$ is divided by $2x-1$.

A. -10

B. -5

C. 5

D. 10

9. A sum of $84000 is deposited at an interest rate of 8% per annum for 5 years, compound monthly. Find the interest correct to the nearest dollar.

A. $2836

B. $33600

C. $40341

D. $41147

10. Let a , b and c be non-zero numbers. If $2a=3b$ and $a:c=4:3$, then $\dfrac{a+2b}{5b-c}=$

A. $\dfrac{16}{27}$.

B. $\dfrac{24}{37}$.

C. $\dfrac{28}{31}$.

D. $\dfrac{7}{6}$.

11. The solution of $7x-6\geq 5(x+4)$ and $\dfrac{8-5x}{3}<-19$ is

A. $x\leq 13$.

B. $x\geq 13$.

C. $x<13$.

D. $x>13$.

12. It is given that w varies directly as the x and inversely as square root of y. If x is decreased by 10% and y is increased by 44%, then w

A. is increased by 34%.

B. is decreased by 25%.

C. is increased by 60%.

D. is decreased by 37.5%.

13. Let a_n be the nth term of a sequence. If $a_1 = 2$, $a_2 = 5$ and $a_{n+2} = a_n + 2a_{n+1}$ for any positive integer n, then $a_5 =$

A. 19 .

B. 29 .

C. 37 .

D. 70 .

14. Let h and k be real constants with $h > 0$. Which of the following statements about the graph of $y = h(k - x)^2 + h$ must be true?

I. The graph opens upwards.
II. The vertex of the graph is (h, k).
III. The y-intercept of the graph is positive.

A. I and II only

B. I and III only

C. II and III only

D. I , II and III

15. The base of a solid right pyramid is a square with length 8 cm . If the total surface area is 144 cm^2 , find the volume of the pyramid.

A. 64 cm^2

B. 96 cm^2

C. $\frac{320}{3}$ cm^2

D. 192 cm^2

16. In the figure, OPQ and ORS are sectors with centre O , where $OP = 10$ cm and $OR = 18$ cm . The area of the shaded region $PQSR$ is 84π cm^2 . Which of the following is/are true?

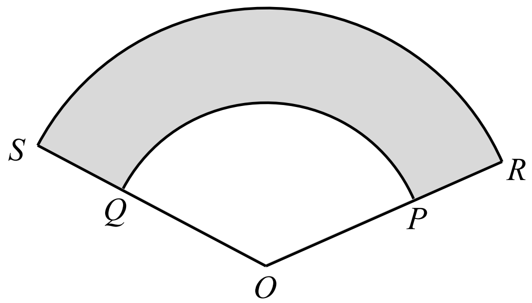
I. The angle of the sector OPQ is $135°$.
II. The area of the sector ORS is 108π cm^2 .
III. The perimeter of the shaded region $PQSR$ is $(21\pi + 16)$ cm .

A. I only

B. II only

C. I and III only

D. II and III only



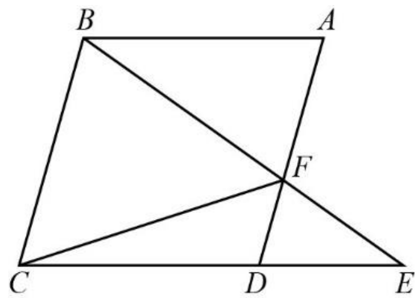
17. In the figure, $ABCD$ is a parallelogram. F is a point lying on AD such that BF produced and CD produced meet at E . It is given that $AF : FD = 5 : 3$. If the area of ΔDEF is 135 cm^2 , then the area of parallelogram $ABCD$ is

A. 720 cm^2 .

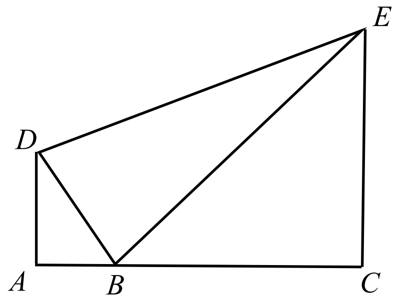
B. 750 cm^2 .

C. 1065 cm^2 .

D. 1200 cm^2 .



18. In the figure, ABC is a straight line. $AD // CE$ and $\angle DAB = 90°$. $DB = 10$ cm, $BE = 24$ cm, $DE = 26$ cm and $AB = 6$ cm. Find the perimeter of the quadrilateral $ACED$.



A. 68 cm

B. 73.6 cm

C. 74 cm

D. 79.6 cm

19. The length of a ribbon is measured to be 95 cm, correct to the nearest cm. The length of a rope is measured to be 150 cm with a percentage error of 2%. Find the upper limit of the difference in the length between the rope and the ribbon.

A. 52.5 cm

B. 57 cm

C. 58.5 cm

D. 59.5 cm

20. $ABCDE$ is a regular pentagon. The diagonals AC and BD intersects each other at F. Which of the following are true?

I. $AF = FC$.
II. $\Delta ABF \sim \Delta ACD$.
III. $AEDF$ is a rhombus.

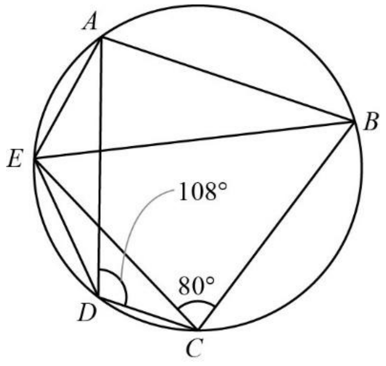
A. I and II only

B. I and III only

C. II and III only

D. I, II and III

21. In the figure, $ABCDE$ is a circle. It is given that $AE:DE=5:4$, $AB // DC$, $\angle ADC = 108°$ and $\angle BCE = 80°$. Find $\angle EBC$.



A. 37°

B. 39°

C. 40°

D. 42°

22. $\dfrac{\sin(270°+\theta)\cos\theta}{\cos(360°-\theta)} - \dfrac{1}{\cos(180°-\theta)} =$

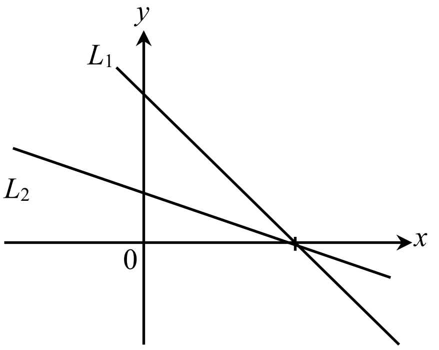
A. $\sin\theta$.

B. $-\sin\theta\tan\theta$.

C. $\sin\theta\tan\theta$.

D. $\dfrac{1-\sin\theta\cos\theta}{\cos\theta}$.

23. The figure shows the straight lines $L_1: ax+y=b$ and $L_2: x+cy=1$, where a , b and c are constants. Which of the following must be true?



I. $a = b$

II. $c < 0$

III. $ac < 1$

A. I only

B. II only

C. I and III only

D. II and III only

24. The polar coordinates of the points A, B and C are $(30, 32°)$, $(18, 122°)$ and $(24, 302°)$ respectively. Find the area of ΔABC.

A. 216

B. 486

C. 576

D. 630

25. It is given that A and B are two distinct points on the straight line $x - 2y + k = 0$, where k is a constant. Let P be a moving point in the rectangular coordinate plane such that $AP^2 + BP^2 = AB^2$. If the equation of the locus of P is $x^2 + y^2 - (44+k)x + 2y + 17 = 0$, $k =$

A. -20.

B. -16.

C. 16.

D. 20.

26. Let h and k be constants. The coordinates of the points A and B are $(3, k)$ and $(20, 8)$ respectively. The straight line $hx + 2y - 29 = 0$ is an altitude of ΔOAB that passes through A, where O is the origin. $k =$

A. -5.

B. 7.

C. 14.

D. 22.

27. The equation of the circle C is $2x^2 + 2y^2 - 12x - 4y + 15 = 0$. Which of the following is/are true?

I. The coordinates of the centre of C is $(6, 2)$.
II. The area of the circle is 2.5π.
III. C cuts the y-axis at two distinct points.

A. I only

B. II only

C. I and III only

D. II and III only

28. Two numbers are randomly drawn at the same time from six cards numbered 1, 2, 4, 5, 7, 8 respectively. Find the probability that the sum of the two numbers drawn is less than 10 .

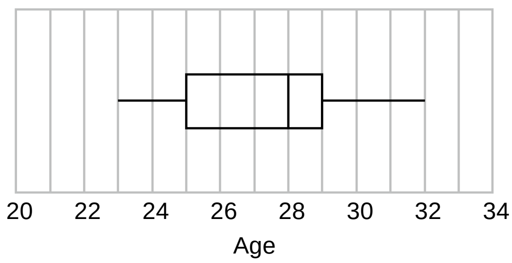
A. $\frac{3}{10}$

B. $\frac{1}{3}$

C. $\frac{2}{3}$

D. $\frac{3}{5}$

29. The box-and-whisker diagram below shows the distribution of the ages of students in a baking class. Find the inter-quartile range of the distribution.



A. 4

B. 5

C. 6

D. 9

30. The stem-and-leaf diagram below shows the distribution of the ages of the workers in a company, where x and y are integers with $0 \le x, y \le 9$.

Stem (tens)	Leaf (units)
2	2 2 6
3	5 7 7 x
4	2 y

If the range and the mode of the above distribution are 22 kg and 37 kg respectively, find the standard deviation of the distribution correct to 3 significant figures .

A. 7.24 kg .

B. 7.76 kg .

C. 8.13 kg .

D. 8.23 kg .

Section B

31. The H.C.F. and the L.C.M. of three expressions are $2a^2b^2$ and $20a^4b^5$ respectively. If the first expression and the second expression are $4a^4b^2$ and $20a^3b^3$ respectively, then the third expression is

A. $2a^2b^5$

B. $2a^4b^2$

C. a^2b^5

D. a^4b^2

32. $7\times16^2+5\times4^2+3=$

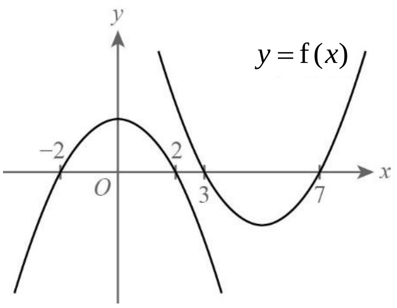
A. 1110101011_2

B. 11101010110_2

C. 11101010011_2

D. 111001010011_2

33. Let $f(x)$ be a quadratic function. The figure below represents the graph of $y=f(x)$ and the graph of



A. $y=-f(x+5)$.

B. $y=f(-x+5)$.

C. $y=-5f(x)$.

D. $y=f(-5x)$.

34. It is given that $\log_4 y$ is a linear function of $\log_2 x$. The intercepts on the vertical axis and on the horizontal axis of the graph of the linear function are 5 and 3 respectively. Which of the following must be true?

A. $x^5 y^3 = 2^{30}$

B. $x^3 y^5 = 2^{30}$

C. $x^{10} y^3 = 2^{30}$

D. $x^3 y^{10} = 2^{30}$

35. For $0° < x \le 360°$, how many roots does the equation $7\cos x + 4\sin^2 x = 7$ have?

A. 1

B. 2

C. 3

D. 4

36. Let a_n be the nth term of a geometric sequence. Given that $a_1 + a_2 + a_3 + ... + a_8 = \sqrt{2} + 1$ and $\dfrac{a_5}{a_4} = \sqrt{2}$, which of the following must be true?

I. a_1 is rational.

II. $a_{20} < 50$

III. $a_1 + a_2 + a_3 + ... + a_{20} < 150$

A. I only

B. III only

C. I and II only

D. II and III only

37. Consider the following system of inequalities:

$$\begin{cases} 3x+4y-32\le 0 \\ 2x+5y-26\le 0 \\ x\ge 0 \\ y\ge 0 \end{cases}$$

Let R be the region which represents the solution of the above system of inequalities. Find the constant k such that the greatest value of $9x+10y-k$ is 55, where (x, y) is a point lying in R.

A. –3

B. 37

C. 41

D. 43

38. Let $u=\dfrac{1}{\cos\theta-i\sin\theta}$ and $v=\sin\theta+i$ where $0°\le\theta\le 360°$. Define $z=u^2+v^2$. Which of the following must be true?

I. The imaginary part of u is equal to the real part of v.

II. The imaginary part of z is equal to $2\sin\theta\cos\theta$.

III. The real part of z is equal to $-\sin^2\theta$.

A. I and II only

B. I and III only

C. II and III only

D. I , II and III

39. Let k be a constant. If the straight line $x+2y-k=0$ and the circle $x^2+y^2-8x+12y-48=0$ intersect at two distinct points A and B, then the y-coordinate of the mid-point of AB is

A. $\dfrac{28-4k}{5}$.

B. $\dfrac{4k-28}{5}$.

C. $\dfrac{14-2k}{5}$.

D. $\dfrac{2k-14}{5}$.

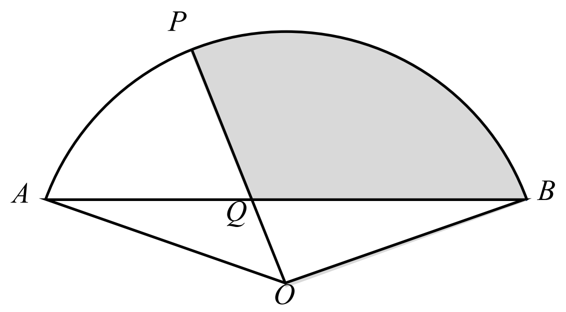
40. The figure shows a sector AOB with centre O. P is a point on AB with $AP:PB=3:4$. AB and OP intersect at Q. $OA = 10$ cm and $\angle OAB = 27°$. Find the shaded area correct to the nearest 0.1 cm^2.

A. 19.1 cm^2

B. 21.9 cm^2

C. 39.1 cm^2

D. 41.0 cm^2



41. Let k be a positive constant. The straight line $5x-12y-60k=0$ cuts the x-axis and y-axis at A and B respectively. Denote O the origin and C the inscribed circle of ΔOAB. If the length of the radius of C is 52 units, find the coordinates of the intersection of C and AB.

A. $(72,100)$

B. $(72,-100)$

C. $(78,-108)$

D. $(100,-72)$

42. A queue is formed by 6 adults and 3 children. If no children stand next to each other and no children are at any of the two ends, how many different queues can be formed?

A. 43 200

B. 86 400

C. 151 200

D. 332 640

43. Peter takes part in three different mathematics competitions. The probabilities for him to get a distinction in the three competitions are 0.2 , 0.3 and 0.15 respectively. Find the probability that he gets a distinction in at least 1 competition.

A. 0.407

B. 0.524

C. 0.65

D. 0.991

44. In a test, the scores of Carol and David are 72 marks and 56 marks respectively. If the standard deviation of the test scores is 8 marks, then the difference of the standard scores of Carol and David is

A. 2 .

B. 8 .

C. 16 .

D. 128 .

45. The mean and variance of a group of numbers $\{x_1, x_2, x_3, \ldots, x_{20}\}$ are 14 and a respectively. Let k be a constant. If the mean and variance of another group of numbers $\{kx_1 - 3, kx_2 - 3, kx_3 - 3, \ldots, kx_{20} - 3\}$ are 25 and $a + 9$ respectively, $a =$

A. 2 .

B. 3 .

C. 9 .

D. 12 .

END OF PAPER